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Development and Validation of Web-based Courseware for Junior Secondary School Basic Technology Students in Nigeria

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ABSTRACT

This research aimed to develop and validate a web-based courseware for junior secondary school basic technology students in Nigeria. In this study, a mixed method quantitative pilot study design with qualitative components was used to test and ascertain the ease of development and validation of the web-based courseware. Dick and Carey instructional system design model was adopted for developing the courseware. Convenience sampling technique was used in selecting the three content, computer and educational technology experts to validate the web-based courseware. Non-randomized and non-equivalent Junior secondary school students from two schools were used for field trial validation. Four validating instruments were employed in conducting this study: (i) Content Validation Assessment Report (CVAR); (ii) Computer Expert Validation Assessment Report (CEAR); (iii) Educational Technology Experts Validation Assessment Report (ETEVAR); and (iv) Students Validation Questionnaire (SVQ). All the instruments were face and content validated. SVQ was pilot tested and reliability coefficient of 0.85 was obtained using Cronbach Alpha. CVAR, CEAR, ETEVAR were administered on content specialists, computer experts, and educational technology experts, while SVQ was administered on 83 JSS students from two selected secondary schools in Minna. The findings revealed that the process of developing web-based courseware using Dick and Carey Instructional System Design was successful. In addition, the report from the validating team revealed that the web-based courseware is valuable for learning basic technology. It is therefore recommended that web-based courseware should be produced to teach basic technology concepts on large scale.

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1. INTRODUCTION

The role of science and technology for any nations cannot be overemphasized. It is very important to note that without the knowledge of basic technology, Nigeria as a nation might be left behind in the scientific and technological race [1]. Nigerian government realized the paucity of technology for national development and this made her to integrate basic technology into Junior Secondary School curriculum [2]. One of the major objectives of basic technology is to enable the individual student to acquire appropriate skills, abilities and competence to live and contribute effectively to the development of his society [3]. To achieve this objective, there is the need for adequate commitment in the teaching and learning of basic

technology in Nigeria junior secondary schools in such a way that, students' poor performance in the subject will be eliminated.

Over the years, students' performance in basic technology has not been encouraging. Basic technology, like other science subjects, recorded poor students' performance both in internal and national examinations. Many factors contributed to the poor performance of students in basic technology examination [4]. These factors include; inability of the teachers to put across the concepts to the students, lack of skills and competence required for teaching, shortage of qualified basic technology teachers, lack of teaching materials and necessary equipment. The causes of poor performance have been attributed to lack of interest in the subject or lack of understanding of the subject due to its abstractness as a result of poor school infrastructure, poorly equipped workshops, non-availability and utilization of instructional materials, lack of qualified personnel (teachers and workshop assistants), and poor instructional strategies [5].

Globally, solutions to existing problems have been a trend in instructional activities. Efforts are therefore necessary to find solutions to the numerous problems encountered in teaching and learning processes. In the quest of seeking for systemic solutions to students learning problems, Educational Technology which is all about imparting knowledge using ICT tools could be of help, hence, new educational technologies such as game-based learning, mobile learning, web-based instruction, among others could shift the teacher-centered and learning environment to a student-centered environment that is more beneficial [6]. Web-based instruction (WBI) is becoming a favored training option in industry, government, and education.

For the purposes of this review, online instruction is referred to as Web-based instruction. The web-based learning is relatively new in Nigerian public secondary schools. WBI is a hypermedia-based instructional program which utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning is fostered and supported. WBI is delivered via the computer using the Internet, making it capable of instant updating, distribution, and sharing of information [7].

Web-based instruction encompasses the integrated design and delivery of instructional resources via the World Wide Web and promotes students' engagement with text-based, hypermedia, multimedia, and collaborative resources for the purposes of teaching and learning [8]. Nigeria has joined the global race in the growth and usage of ICT [9]-[10]. This is evident by the growth in the use of the internet and the adoption of computer in schools. For instance, there is a proposed MTN Education bundle (a laptop) pre-loaded with rich educational content specially designed for children from pre-Primary to senior Secondary. Similarly, the 'Opon-Imo' is an e-learning computer tablet which comprises the entire educational needs of students in the Senior Secondary School classes. It is said to have 63,000 e-books, covering 17 subjects, a whole English dictionary, video tutorials, past questions for the last 10 years and lots more. It is an ICT innovation by the Osun State government.

World Wide Web is a small part of the internet. It is made up of the web pages that can be seen when connected to the internet. All web pages on the internet will have an address prefixed by www. The World Wide Web (the web) is not separate from the internet; instead it makes it to be more efficiently easy to use [8]. Web-Based Instruction is teaching and learning supported by the attributes and resources of the Internet. Web-Based Instruction offer one of the robust learning environments for complex text, graphical, and voice-based social interactions and experiences. The World Wide Web can be used to provide instruction and instructional support. Web-based instruction offers learners unparalleled access to instructional resources than the traditional classroom. It also makes possible learning experiences that are open, flexible, and distributed, providing opportunities for engaging, interactive, and efficient instruction [7]. Effective online learning is dependent upon the principles of instructional design and development.

The design of web-based instruction must take into account cognitive processing of information, learning tasks, the learner, and an instructional tool [11]. To support learning, the design of the online learning environment requires a shift in focus from content-delivery to a task-based instructional approach with opportunities for reflection and collaboration [12].

In this study, Dick and Carey instructional design model was used in developing the web-based courseware. Several instructional models were developed to achieve the same goal. For instance, Singh (2009) study suggested that using a systematic approach such as ADDIE to develop a valid and effective interactive web-based module was still viable. Similarly, [13] adopted the design model provided by [14] and the social constructivist learning theory. The adopted model allowed development of the package to take less time and effort as it starts with specific set of prescribed objectives. In addition, [15] conducted a study on Design, Development, and Validation of Learning Objects. Results confirmed that the use of modular Web-based learning are a viable object can be successfully designed and used for independent learning.

Studies of the web-based learning environments have shown that development and validation. Carried out a study on development and validation of a computer- assisted instructional package for learning basic science in Nigeria [13]. The overall reaction from the validating team revealed that the developed

package (CAIP) is valuable for learning physics concept in Basic science. Similarly, [16] conducted a study designed to test the validity and reliability of the Web-based Learning Environment Instrument (WEBLEI). The findings evidence that the WEBLEI is valid and reliable measure of Turkish students' perceived web-based learning environments traits. In a similar study, [17] conducted a study on design, development and validation of a web-based instructional package for teaching ceramics concepts in basic technology for junior secondary school students in Nigeria. The results revealed that comments received from experts and student representatives confirmed that the content, navigation mode, interactivity, structure, colour used and authoring tools used were relevant and it was of good quality for the intended users [18]. Development of web-based learning environment model to enhance cognitive skills for undergraduate students in the field of electrical engineering. The results of model implementation efficiency revealed that students who studied by using the developed web-based learning environment model received pre-and post-points of – achievement (52.37 and 92.40%). It was assumed that the web-based learning environment model had its quality at the highest level and could be used as a pedagogical tool for undergraduate students. In a similar study conducted by [19] on the development and validation of online learning modules for college English. The results show that the students exposed to the online modules in online portals performed better than those receiving traditional instruction in a classroom. In an overall perspective, the students were to a large extent satisfied with online instruction.

However, [20] developed and validated a computer-based learning module for wrist arthroscopy. The study revealed that the computer based module did not enhance learning, the participants did find the module more pleasant to use. Developing learning tools such as this computer-based module can improve the teaching of wrist arthroscopy skills.

In spite of the increased popularity and adoption presence of web-based learning opportunities, there is a limited study on students' development and validation of web-based learning environments in Nigeria. However, in order to promote active engagement of the learners and delivery of meaningful learning in the web-based learning settings, it is necessary to develop and validate a web-based courseware for teaching basic technology at junior secondary school level in Nigeria.

2. STATEMENT OF THE PROBLEM

Presently, Nigeria is like many other developing nations across the globe facing rapid increase in adoption of computers, networks and web technology. Due to the more feasible application of the web-based learning for supporting teaching and learning, most Nigeria private secondary schools and some few public schools have adopted the web-based technologies to support their traditional learning environments. For a shift from teacher-centered learning environment practiced by teachers which is one of the factors attributed to poor performance among secondary school students, there is need for improvement in teaching and learning. Hence, the quest for more effective instructional strategies like web-based instruction, virtual learning, and mobile learning among others. Web-based instruction as one of the student-centered strategy is yet to be imbedded in teaching and learning in Nigerian classrooms.

Web-based instruction can be used to transform classroom instruction into a series of rich memorable experiences and thus, reduce boredom and forgetfulness in teaching subjects such as Basic Technology. There is therefore need to develop and validate web-based instructional courseware for basic technology in Nigerian secondary schools.

3. AIM AND OBJECTIVES

The aim of this study is to develop and validate web-based courseware for junior secondary school basic technology students in Nigeria. Specifically, the study sought to:

(i) Determine the steps involved in developing web-based courseware for junior secondary school basic technology students in Nigeria.
(ii) Find out how the developed web-based courseware for junior secondary school basic technology students in Nigeria was validated.

4. RESEARCH QUESTIONS

The following research questions were raised to guide the study:

(i) What are the steps involved in the development of web-based courseware for junior secondary school basic technology students in Nigeria?
(ii) How was the developed web-based courseware for junior secondary school basic technology in Nigeria validated?

5. RESEARCH METHODOLOGY

5.1. Research Design

This study adopted instrumentation design (ID) which involves design, development and the validation of the instruments needed for certain implementation in science, technology, industry and medicine [21]. Instrumentation in this study is on the realization of a teaching tool which can be tested and assessed to check if the design really solved problem that brought its development. The design of this study fits into the definition of instrumentation given by the International Centre for Educational Evaluation (1982) which states that a study belongs to instrumentation research if it is aimed at developing new, modifying content, procedure, technology or instrument of educational practice. In addition, a mixed method quantitative pilot study design with qualitative components was used to test and ascertain the ease of development and validation of the web-based courseware.

5.2. Sample and Sampling Technique

The population for this research consists of basic technology teachers, industrial and technology education lecturers, computer experts, educational technology experts and JSSIII students in secondary schools in Minna, Niger State. Convenient sampling technique was used to select three senior lecturers from Industrial and Technology Education Department, Federal University of Technology, Minna and three senior basic technology teachers from three secondary schools in Minna to validate the content of the basic technology for junior secondary school Class three (JSSIII). Purposive sampling technique was adopted to select three experienced computer programmers from Computer Science and Cyber Security Departments and three Educational Technology lecturers from Educational Technology Department, Federal University of Technology, Minna. Furthermore, simple random sampling technique was used to select 83 junior secondary school students from Peace Secondary School, Minna(n = 41) and St. Clement Secondary School, Minna (n = 41) for field trial validation of the web-based courseware (WBC).

5.3. Research Instruments

Four research instruments were employed in conducting this study: (i) Content Validation Assessment Report (CVAR); (ii) Computer Expert Validation Assessment Report (CEAR); (iii) Educational Technology Experts Validation Assessment Report (ETEVAR); and (iv) StudentsValidation Questionnaire (SVQ).

(i) Content Validation Assessment Report (CVAR): This instrument contains eight statements which respondents were required to write their comments after using the web-based courseware. These include: appropriateness of the WBC for teaching the choosen topics; clarity and simplicity of the WBC; suitability for the level of the students; the extent to which the contents cover the topics; possible errors in the suggested answers; the structuring of the WBC; and other comments on the grammatical errors, misrepresentation of the symbols in the WBC, among others. Furthermore, a space for free comments was also provided. This instrument was given to three senior lecturers from Industrial and Technology Education Department, Federal University of Technology, Minna for face and content validation of the web-based courseware for basic technology with regards to the officially prescribed content of National Education Research and Development Council's (NERDC) curriculum.

(ii) Computer Expert Validation Assessment Report (CEAR): This instrument contains nine statements which respondents were required to write their comments after using the web-based courseware. These include: Appropriateness of the programming language used; typography errors in the WBC; legibility of the WBC; the navigation; theinterface; the animations in the WBC; functionality of the WBC; the storage, speed and durability of the WBC; and the appropriateness of the applications in the WBC. CEAR was given to three (3) lecturers from Computer Science and Cyber Security (programmers) Departments, Federal University of Technology, Minna for experts'validation after they had gone through the web-based courseware.

(iii) Educational Technology Expert Validation Assessment Report (ETEVAR): This instrument consists of seven statements which respondents were required to write their comments after using the web-based courseware. These include: suitability of the WBC for instruction; clarity and simplicity of the WBC; unity among illustrations; emphasis on key concepts; the use of colours (background and font colours); the legibility of the text (font type and size); and others such as audibility of the audio, animation, etc. ETEVAR was given to three (3) educational technology experts from Educational Technology Department, Federal University of Technology, Minna for the purpose of finding out whether the web-based courseware conforms with acceptable standards in educational technology.

(iv) Students Validation Questionnaire (SVQ): The instrument contains six section (A-F) and each section contains five statement items which respondents were required to state whether they are strongly agreed, agreed, disagreed, strongly disagreed respectively. Section A contains five-item on content in the WBC;

section B has five-item on interactivity of the WBC; Section C consists of five-statement navigation of the WBC; Section D contains five-item on feedback from the respondents after using the web-based courseware; Section E has five-item that deals with screen design of the web-based courseware; while Section F contains five-statements on students' preferences toward the use of the web-based courseware to traditional method of teaching.SVQ wasadministered on 83 students who were randomly selected for field trial validation of web-based courseware for basic technology.

5.4. Method of Data Collection

Data were collected in two ways using qualitative and quantitative methods. Qualitative data on web-based courseware were collected from Industrial and Technology Education lecturers, Basic Technology Teachers, Computer programmers, Educational Technology experts. The experts responded to statements in: (i) Content Validation Assessment Report (CVAR); (ii) Computer Expert Validation Assessment Report (CEAR); (iii) Educational Technology Experts Validation Assessment Report (ETEVAR) respectively. The quantitative data were also obtained from 83selected students using Students Validation Questionnaire (SVQ).

5.5. Data Analysis Technique

Research question one was answered by explaining the steps involves in developing web-based courseware. Research question two was answered using qualitative data and quantitative data. The summary of comments and recommendations from experts on validation were reported, while responses fromstudents from field trail validation were analyzed using descriptive statistics of mean and standard deviation.In taking decision from the analyzed data, an average mean of 2.50 and above were considered as agreed, while an average mean of 2.49 and below was considered disagreed with respect to the research questions. A mean of 2.5, according to David (2005), was used as a criterion to judge mean scores for a modified four- point item format. The mean of 2.5 was calculated from the sum of 4+3+2+1 divided by 4.

6. RESULTS

Research Question One: What are the steps involved in the development of web-based courseware for junior secondary school basic technology students in Nigeria?

This studyadopted the ten steps of instructional design as provided by the Dick and Carey model (2005) as shown in Figure 1.

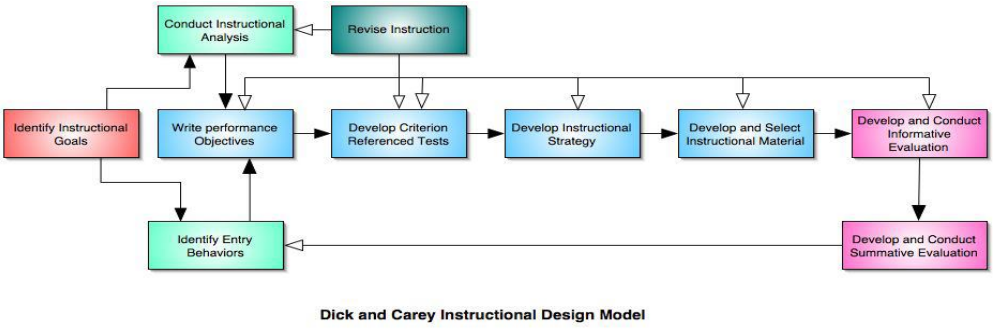

Figure 1. Dick and Carey Instructional Design Model

This model is based on a systems approach for designing instruction. It views instruction as an entire system, centering more on the interrelationship between context, content, learning and instruction. The model has nine major process components i.e. nine basic steps in an iterative cycle and a concluding evaluation of the effectiveness of the instruction. The nine components in an iterative cycle include:

(i) Assess needs to identify instructional goal(s);
(ii) Conduct instructional analysis;
(iii) Identify entry behaviour;
(iv) Write performance objectives
(v) Develop assessment instrument;
(vi) Develop instructional strategy;

(vii) Develop and select instruction;
(viii) Design and conduct formative evaluation;
(ix) Revise instruction; and
(x) Design and conduct summative evaluation (Dick & Carey, 2005).

Stage 1: In assessing the needs to identify instructional goal(s), three basic technology teachers and researchersidentified the difficult topics in Junior Secondary School class three (JSSIII) Basic Technology. Over dependent on teacher-centered approach of teaching and lack of using Internet for teaching and learning were identified as one of the problems for poor performance at JSS level. Hence, the need for developing web-based learning.

Stage 2: In conducting the instructional analysis, methods of instructional delivery for teaching basic technology at junior secondary school level were identified. This include the facilities, equipment, manpower and infrastructure available for instructional purposes.

Stage 3: In identifying entry behavior, the previous knowledge of the JSS III students must be identified. Concepts of basic technology taught at junior secondary class two (JSSII) were identified. Students were examined on their previous knowledge on some related concepts in basic technology.

Stage 4: In writing the performance objectives, the topics identified were structured from simple to complex, known to unknown, abstract to concrete. In this study, the objectives for each topic were formulated.

Stage 5: In developing assessment instrument, various instruments were used to determine the functionality of web-based courseware. In this study, (i) Content Validation Assessment Report (CVAR); (ii) Computer Expert Validation Assessment Report (CEAR); (iii) Educational Technology Experts Validation Assessment Report (ETEVAR); and (iv) Students Validation Questionnaire (SVQ) were developed.

Stage 6: In developing instructional strategy, justification for using web-based instructional courseware were identified. The necessity for developing web-based instructional courseware was based on the fact that the available web-based courseware on the Internet were not directly relevant to the concepts of this study as they are not culturally relevant to basic technology instruction in Nigeria. Hence, there is need to develop web-based courseware.

Stage 7: In developing and selecting instruction for web-based courseware, the researchers identified the content of a web-based instruction, typed the JSS III basic technology course material, develop the storyboard and forwarded it to the programmer. The computer programmer determined the types of web pages to be used, identified the equipment and software for design and development of a web-based instruction. In this study, Macromedia Dreamweaver, Macromedia Fireworks, PHP programming language and MYSQL software were used for creating database. At the completion of the web-based courseware, programmer identified a host company to help store the file at the remote server and finally hosted the website.

Stage 8: In designing and conducting formative evaluation, various validation stages were employed. This include: content validation, experts' validation, one-to-one student validation, small group validation, field trial validation among others.

Stage 9: This stage involved revising the instruction, each steps were revised and all the necessary amendment were made based on validation assessment reports from experts and students. The researcher checked the entry behavior again and follow the loop again until the web-based courseware met the standard.

Stage 10: The final stage of Dick and Carey Model is designing and conducting summative evaluation [22]. This involve the testing of the final product with the end users.

Research Question Two: How was the developed web-based courseware (WBC) for junior secondary school basic technology in Nigeria validated?

The validation of WBC was done in three stages: (i) content validation (basic technology specialists), (ii) experts validation (computer programmers &educational technology experts), and (iii) field trial validation (students' representative).

(i) Content Validation: this was divided into two stages: (a) content validation of the course material, (b) content validation of web-based courseware.

(a) Content Validation of the Course Material: After developing the contents of selected difficult concepts in basic technology, three senior basic technology teachers were given the content to validate using Content Validation Assessment Report (CVAR). They assessed the appropriateness of the web-based content for teaching the topics, clarity and simplicity of the contents, suitability for the level of the students, the extent to which the contents cover the topics they are meant to cover, possible errors in the suggested answers, the structuring of the WBC among others before the WBC was developed. They ascertained that the contents complied with NERDC curriculum. They also ensured that all question items were derived from the contents.

(b) Contents Validation of Web-based Courseware: The contents of the courseware were validated by three senior lecturers from Industrial and Technology Education, Federal University of Technology Minna

using Content Validation Assessment Report (CVAR). They examined the contents of the WBC whether it adequately and sufficiently cover the Nigerian secondary school Basic Technology curriculum. After the validation, some sentence errors, spelling mistakes, and misrepresentation of some symbols in the web-based courseware were corrected. Some paragraphs and formatting errors were discovered and corrected. The test items and contents of the web-based courseware were also corrected based on the suggestions and recommendations of the experts.

(ii) Experts Validation: this was done in two stages: (a) Computer Experts Validation, (b) Educational Technology Experts Validation.

(a) Computer Experts Validation: The developed web-based courseware was validated by three computer experts (from Computer Science and cyber Security Departments) to validate using Computer Expert Validation Assessment Report (CEAR).They examined the appropriateness of the WBC in terms of language, typography, legibility, navigation, interface, animations/video, functionality, packaging, and durability. Their suggestions and recommendations were used for modifying the web-based courseware.

(b) Educational Technology Experts Validation: Three Educational Technology experts from Educational Technology Department validated the web-based courseware by looking at: its suitability for instruction, simplicity, unity among illustrations, and emphasis on key concepts, colour use, and text. In addition, three basic technology experts and two basic technology teachers also validated the WBC in terms of its appropriateness for teaching the topics, clarity and simplicity of the WBC, suitability for the level of the students, the extent to which the contents cover the topics they were meant to cover, possible errors on the suggested answers, the structuring of the web-based courseware and others. Furthermore, comments and recommendations on font types and sizes were effected by changing the font type to legible one and increase the font size moderately. Also, some background colours that seem to be distractive were changed. All the experts' comments were used to improve the web-based courseware.

(iii) Field Trial Validation: The WBC was trial-tested on some 83 Junior Secondary School Basic Technology students from Peace Secondary School, Tunga and St. Clement Secondary school, Minna. The students were taught basic technology using WBC for three weeks using double period of 80 minutes' duration. They were allowed to connect to the website (www.basictechedu.com)using the password assigned to each student to log in. The purpose of field trial validation is to confirm the functionality of the web-based courseware. After three weeks of exposure to web-based courseware, 30-item Students' Validation Questionnaire (SVQ) was administered to the students exposed to web-based instructional courseware and retrieved immediately and analyzed as shown in Table 1-6.

Table 1 shows the cumulative mean of 3.50 for students' opinions of the content in the web-based courseware. This implies that students agree that content in the web-based courseware are adequate. This is because the cumulative mean 3.50 is greater than the decision mean of 2.50.

Table 1. Content in the Web-based Courseware

S/No	Statement	Mean	SD	Decision
1	The messages in the web-based courseware are easy to understand.	3.62	0.53	Agree
2	The content of the web-based courseware has been well organized (arranged in order).	3.67	0.64	Agree
3	The diagrams/illustrations in the web-based courseware are very clear to me.	3.42	0.69	Agree
4	The examples used in the various sections of the lessons in the web-based courseware are relevant.	3.42	0.66	Agree
5	It was easy to understand the lesson because information was presented from simple to more difficult one.	3.38	0.81	Agree
	Cumulative Mean	3.50		

Decision Mean = 3.50

Table 2 shows the cumulative mean of 3.67 for students' opinions of the interactivity of web-based courseware. This implies that students agree that the interactivity of the web-based courseware are adequate. This is because the cumulative mean 3.67 is greater than the decision mean of 2.50.

Table 2. Interactivity of the Web-based Courseware

S/No	Statement	Mean	SD	Decision
6	It is easy to operate the web-based courseware with computer keys and icons.	3.67	0.56	Agree
7	This package permits me to repeat the section, enlarge animation, and exit the lesson at any time.	3.87	0.34	Agree
8	The frequent display of questions to the learners does not interrupt the learning process.	3.42	0.92	Agree
9	This package enables me to apply what I have learnt rather than memorize it.	3.67	0.56	Agree
10	This package allows me to discover information through active learning.	3.71	0.46	Agree
	Cumulative Mean	3.67		

Decision Mean = 3.67

Table 3 shows the cumulative mean of 3.88 for students' opinions on the navigation of the web-based courseware. This implies that students agree that the navigation of the web-based courseware are adequate. This is because the cumulative mean 3.88 is greater than the decision mean of 2.50.

Table 3. Navigation of the Web-based Courseware

S/No	Statement	Mean	SD	Decision
11	From the main menu, learners are allowed to register his/her name.	3.91	0.29	Agree
12	The EXIT key enables me to exit from the lesson.	3.82	0.39	Agree
13	The PREVIOUS key enables me to revisit the previous section(s) of the lesson.	3.96	0.21	Agree
14	The NEXT key directs me to go to the next section of the lesson.	3.87	0.34	Agree
15	The OPTION keys allow me to select the correct option.	3.84	0.42	Agree
	Cumulative Mean	3.88		

Decision Mean = 3.88

Table 4 shows the cumulative mean of 2.99 for students' opinions on the feedback from web-based courseware. This implies that students agree that the feedback from web-based courseware are adequate. This is because the cumulative mean of 2.99 is greater than the decision mean of 2.50.

Table 4. Feedback from the Web-based Courseware

S/N	Statement	Mean	SD	Decision
16	This web-based courseware provides immediate feedback after selecting the option.	3.20	0.76	Agree
17	This web-based courseware displays the correct or wrong answer chosen with some sound.	2.62	0.91	Agree
18	This web-based courseware allows me to proceed to the next lesson only if the chosen answer is correct.	3.62	0.78	Agree
19	This web-based courseware terminates my activities if after three attempts I got the answer wrong.	1.80	1.08	Agree
20	This web-based courseware appreciates my efforts by congratulating me after completing the lesson correctly.	3.71	0.73	Agree
	Cumulative Mean	2.99		

Decision Mean = 2.99

Table 5 shows the cumulative mean of 3.79 for students' opinions on the screen design of the web-based courseware. This implies that students agree that the screen design of the web-based courseware are adequate. This is because the cumulative mean of 3.79 is greater than the decision mean of 2.50.

Table 5: Screen Design of the Web-based Courseware

S/No	Statement	Mean	SD	Decision
21	The presentations of the information in the web-based courseware attract my attention.	3.80	0.40	Agree
22	The use of proper lettering (fonts) in terms of style and size make the information legible.	3.82	0.39	Agree
23	The colours used for the various presentations are quite appealing.	3.80	0.40	Agree
24	The quality of the text, images, graphics and video are interesting.	3.84	0.37	Agree
25	The animations (moving picture) in the web-based courseware assist in understanding the lessons better.	3.71	0.51	Agree
	Grand Mean	3.79		

Decision Mean = 3.79

Table 6 shows the cumulative mean of 3.74 for students' opinions on their preferences toward the use of the web-based courseware compared to traditional methods of teaching. This implies that students' preferences toward the use of web-based courseware compared to traditional methods of teaching are adequate. This is because the cumulative mean of 3.74 is greater than the decision mean of 2.50. Finally, students' responses to web-based instructional courseware were used to improve the courseware.

Table 6. Students' Preferences toward the Use of the Web-based Courseware Compared to Traditional Methods of Teaching

S/No	Statement	Mean	SD	Decision
26	I prefer to learn Basic Technology with WBC with a teacher acting as a facilitator.	3.62	0.78	Agree
27	Learning Basic Technology with web-based is more preferable than using text books.	3.82	0.44	Agree
28	The activities provided in this web-based courseware are more effective compared to normal classroom instruction.	3.87	0.34	Agree
29	I will suggest to my friends to use web-based courseware in learning Basic Technology instead of textbooks.	3.69	0.56	Agree
30	I prefer the use of this instruction method than normal classroom instruction.	3.71	0.63	Agree
	Cumulative Mean	3.74		

Decision Mean = 3.74

7. DISCUSSION OF FINDINGS

The steps in developing web-based was used to answer research question one. Findings on the steps in the development of web-based courseware for JSS basic technology in Nigeria showed that using instructional system design procedures by [22] in developing web-based courseware was successful. This finding is in line with the recommendations of [22] instructional design model. The finding is also in agreement with [12] study which suggested that using a systematic approach such as ADDIE to develop a valid and effective interactive web-based module was still viable. It also agreed with the finding of [13] who reported that adopted design model provided by [14] and the social constructivist learning theory take less time and effort as it starts with specific set of prescribed objectives. In addition, [15] confirmed that the use of modular web-based learning is a viable object that can be successfully designed and used for independent learning.

Findings on how web-based courseware for basic technology in Nigeria can be validated was revealed that experts and students' validation reports were positive. This finding agrees with the finding of [13] who reported that reaction from the validating team and students' field trial validation revealed that the development of computer assisted instructional package is valuable for learning physics concept in Basic science. The finding of this study also agrees with the finding of [16] who revealed that the Web-based learning environment is valid and reliable measure of Turkish students' perceived web-based learning environments traits. This study' finding also agrees with the findings of [17] who designed, developed and validate of a web-based instructional package for teaching ceramics concepts for junior secondary school students in Nigeria. Their results revealed that comments received from experts and student representatives confirmed that the content, navigation mode, interactivity, structure, colour used and authoring tools used were relevant and it was of good quality for the intended users. In addition, this finding is in agreement with the finding of [18] who revealed that web-based learning environment model enhanced cognitive skills for undergraduate students in the field of electrical engineering. The finding of this study also agrees with the finding of [19] who developed and validated an online learning modules for college English and found that students exposed to the online modules in online portals performed better than those receiving traditional instruction in a classroom.

However, this study contradicts the findings of [20] who reported that the developed and validated computer-based learning module for wrist arthroscopy did not enhance learning, and but the participants find the module more pleasant to use.

8. CONCLUSION

Literature revealed that there is few web-based learning courseware developed and validated to facilitate teaching and learning of practical-based science subjects particularly basic technology in Nigeria. This study demonstrated the steps in developing and various stages of validating a web-based courseware for basic technology in Nigeria. Adopting Dick and Carey Instructional System Design Model in developing web-based courseware was successful. In addition, contents specialist reported that the contents covered the required basic technology concepts. Computer programmers also affirmed that the programming language used, navigation, interface, animation, and others are in line with the standard of software development. Educational technology experts reported that simplicity, clarity, unity among illustrations, and emphasis on key concepts, colour use, and font type and sizes were adequate.

9. RECOMMENDATIONS

Based on the major findings of this study, the following recommendations were made:

a. Developers of web-based courseware such as online course module, learning courseware and computer package should ensure that Dick and Carey ISD Model or similar ISD Model is fully implemented. This will serve as a guide towards developing a quality web-based courseware;
b. Content specialists and experts' validation reports should be properly followed towards developing a standard web-based courseware.
c. Basic technology teachers should imbibe the spirit of using web-based courseware for teaching their students in order to enhance learning of technological concepts at junior secondary school level;
d. Web-based courseware is a team work, therefore web developers should involve subject specialists, computer programmers, educational technology experts, and students in the process of developing and validating web-based courseware to ensure high interactivity and users-friendliness of such courseware;
e. Secondary schools in Nigeria should embrace and support the use of web-based courseware in their schools as this will enhance students'performance in basic technology and science related subjects.

Therefore, government and non-governmental organizations should provide ICT infrastructure for effective development and utilization of web-based courseware.

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